

# ARTIFICIAL INTELLIGENCE AND ITS APPLICATIONS IN E-COMMERCE - A REVIEW ANALYSIS AND RESEARCH AGENDA

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## ABSTRACT

The exponential evolution of computing technology is responsible for the massive change in practices and behavior. Artificial Intelligence (AI) is one of the fastest growing computing technologies which have remarkable contribution in transforming business practices and customer experience. However, it is at infancy stage and therefore its application in various industries is in early stage. Research on AI and its application is growing across the World but the existing literature is largely fragmented. To reach on a conclusion or to understand AI application a systematic review is essential. This study synthesizes research on artificial intelligence in electronic commerce. The systematic analysis approach along with extensive review of literature is utilized. A total of 170 literatures were analyzed and out of it 106 are reviewed. The study describes the status quo of AI technology and its role in modernizing e-commerce. The present study begins with introduction of study consisting need of the study, gap in the literature, Artificial intelligence and its prospects, aims of conducting the systematic literature review followed by methodology adopted in the current study. The next part of the study highlights AI and its subsets, e-commerce and application of AI in different e-commerce operations. The study describes how the element of personalization and human touch can be restored in e-commerce using AI. At last discussion, conclusion, future research and limitations of the study are presented. The study identified prominent themes that could be the area of interest for many researchers and academicians. The outcome of the study will bring new dimensions of AI application in e-commerce.

**Keywords:** Literature review, Artificial intelligence, AI- subsets, E-commerce, Systematic review.

## 1. INTRODUCTION

The concept of Artificial intelligence (AI) is developed around 60 years ago. According to [1], "AI is the art of creating machines that perform functions that require intelligence when performed by people." Due to the changes in lifestyles, one needs to have an intelligent technology that not only saves the time but also automates the work. The technological disruptions like AI, Internet of Things (IoT), big data is affecting every person, from house hold to business and professional levels. It has drastically changed the way of conducting day to day operations. The new generation of AI is rapidly expanding in almost every field of work including education, banking, healthcare and finance, leading to benefitting different industries. Artificial intelligence is

considered to be the future of the society. The technology is successfully getting incorporated in every field of work. The movement towards Industry 4.0 is the key driving force for every emerging technology in today's era [2].

E-commerce had come up with new opportunities and experience to the customers. It is not just a flexible platform for purchase and sale of goods and services but it had reached an extra mile. Expansion in the functionalities of e-commerce came in the form of video streaming and music. Apart from shopping convenience entertainment is also available at E-commerce in customized manner. By embedding Artificial intelligence ecommerce sharpen its offering. AI helped to track customers in more detailed manner which further generate new leads and enhanced customer

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experience. Not only for online retailer application of AI equally helpful to the customers in their online shopping journey. It accompanies the customers in every step from browsing the products to make the payment. The success of virtual assistants such as Apple's Siri, Amazon's Alexa or Google home using AI-enabled chat bots to resolve shopping related queries are some of the examples.

To reach on the level of enormous accuracy, flexibility and productivity for e-commerce the methods that come into the space of AI are machine learning, robotics, expert systems, artificial neural networks, data mining, natural language processing and computer vision. [3] in his study reported that AI-enabled systems in the organization are expanding rapidly. More and more automation is being applied to transform e-commerce activities [4]. The rise in the usage of smart devices such as smart phones created a need for e-commerce to update itself to the next level. And the process of updating is impossible without the help of AI which is playing principal role in developing intelligent e-commerce [4].

The objective of this study is to present an overview of published research data on role of AI and its subsets in ecommerce. To achieve its objectives the study focuses on three major issues (i) to present the status quo of AI technology in e-commerce (ii) to describe the usability of different subsets of AI in e-commerce, and (iii) to specify the extent to which AI had replaced human intervention in e-commerce. It will help to understand the current status of AI application in e-commerce and also to recognize any central themes in this domain. The paper is in the form of a literature review, which aims at presentation of recent literature on the topic, comprehensively studying the previously accomplished work and presents the research findings. It is narrative in nature, consisting of conceptual knowledge involving wide range of subjective knowledge on the research area, leading to an empirical understanding of the topic [5]. Since AI is at its infancy stage in e-commerce, a comprehensive view of status quo of the technology is presented. Research work undertaken by scholars in the field of marketing/ e-commerce, decision sciences and computer science is reviewed to reach on any conclusion. The study had comprised of dual aspects of the field. Firstly, the technologies incorporated in the field and secondly, the utility of these technologies in e-commerce. None of the

previously presented studies have provided both the concepts under the same roof. Moreover, the previously presented studies in management have given the functionalities of AI in e-commerce but it fails to highlight the technological aspect behind the same i.e., its fails to show the association of technology with its e-commerce functionality. Moreover the study conducted by [6] had reviewed the contribution of AI in e-commerce with special reference to recommendation systems. The aim themes covered under the study were sentiment analysis, trust and personalization, optimization, AI concepts and related technologies. Majority of previous studies have limited applicability as they had limited itself with one or two aspects of AI. This study had tried to portray a complete picture of AI and its applicability e-commerce.

The next section is about defining methodology used to conduct the literature review leading to the description of artificial intelligence, identifying its various subsets and their working. It then move towards describing the field of e-commerce and application of AI in it. The paper finishes with the discussion and conclusion followed by future research recommendations and limitations of the study.

## 2. METHODOLOGY (see Fig. 1 )

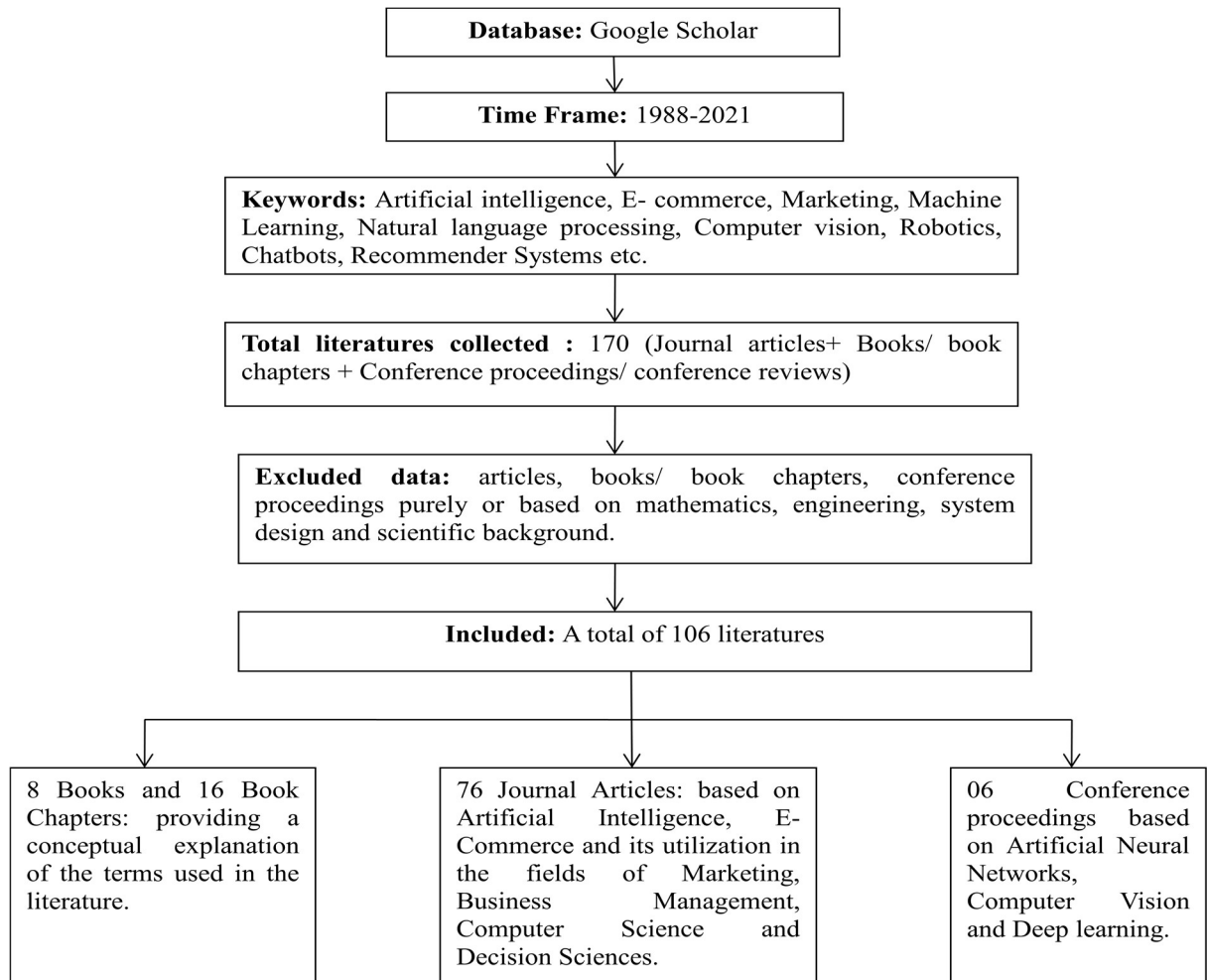


Figure 1: Process adopted for literature review

### 2.1 Selection of bibliometric databases

A systematic review process is followed to ensure the reliability of the research. Google scholar is used as a prominent source to search the relevant literature. In order to ensure the quality of the literature collected a manual check of its indexation was also performed from Scopus, ABDC and Web of Science platforms

### 2.2 Defining keywords

The initial strings used are artificial intelligence and e-commerce. Coordinating conjunctions such as “AND” and “OR” also used to find the holistic view of the data connecting artificial intelligence with e-commerce. Search

strategy used to find out the appropriate literature from review like ‘Artificial intelligence’ OR ‘AI’, ‘machine learning’ OR ‘ML’, ‘Deep Learning’ OR ‘Robotics’ OR ‘AI- Subsets’ OR Recommender Systems’ OR ‘Chat bots’ OR ‘AI AND e-commerce’, ‘Computer Vision AND e-commerce’ et cetera.

### 2.3 Detailing the initial process:

A total of 170 literatures including book/ book chapters, journal articles and conference proceedings are collected and analyzed thoroughly. Business; management; decision sciences; arts & humanities are the prominent field of studies to integrate the database for review. Three distinct

criteria are used to collect the literature of different type.

Criteria 1: It is used to search data from books/ book chapters. Keywords like artificial intelligence, machine learning, computer vision, robotics, artificial neural networks etc. are used. Data under this criterion was collected from books including Google books.

Criteria 2: To search journal articles combination of terms such as 'AI and E-commerce', 'AI and marketing', 'expert systems and e-commerce', 'machine learning and e-commerce', robotics and e-commerce' etc. are used. Data under this criterion was collected from journals of relevant area.

Criteria 3: To obtain conference proceedings in the field of artificial neural networks, computer vision, big data this criteria was used.

A total of 170 literatures including book/ book chapters, journal articles and conference proceedings were collected and analyzed thoroughly. An inclusion and exclusion criteria was also followed, where business; management; decision sciences; marketing are considered the prominent field of studies to integrate the database for review. If in case the data belonged to other fields such as mathematics, engineering, education it was excluded from this study. The adopted criteria are considered essential to provide meaningful insight of the field to the academicians and practitioners. Finally, a dataset of 106 literatures including book, chapters, journals and proceedings are collected. Collected literature consist 8 books and 16 book chapters (provides a conceptual explanation of the terms used in the literature), 76 journal articles mainly focused on Artificial Intelligence and e-commerce (highlighting the utilization of AI in the fields of marketing, business management, computer science and decision science) followed by 6 conference proceedings based on artificial neural networks, computer vision and big data.

The selection of journals is done on the basis of its relevance to the topic. After the collection of data, each and every document including journal articles, books, chapters and conference proceedings are again searched on Scopus/ Web of Science/ ABDC to find it's indexing in order to ensure the quality of the literature reviewed. While examining the process of

indexing it was found that out of 29 books/ book chapters, 15 were Scopus indexed. From 82 journal articles, 79 were indexed in Scopus, 1 is indexed in Directory of Open Access Journal (DOAJ) and 1 in ABDC. Similarly out of 9 conference proceedings, 7 were Scopus indexed.

### 3. ARTIFICIAL INTELLIGENCE

The term artificial intelligence was first coined by John McCarthy in 1956 during the first academic conference on the subject [7]. Artificial intelligence (AI) is the branch of computer science that can perform human oriented tasks such as problem solving, decision making and reasoning similar to human behavior. It operates through sensors and commands and respond to the surrounding environment of operation [8]. McCarthy (1956) defines AI as "the science and engineering of making intelligent machines." In the early stage of evolution of AI, it was resembled to "Department of Clever Tricks" in the field of computer science [9]. These clever tricks have become the inseparable part of computer science and also reflect a sense of human intelligence in itself. AI came into existence with a view to understand and analyze the extent to which machines can replace humans in performing task accurately using big data algorithms [10]. AI works under the scope of reflection and control of human intelligence, but due to the quantitative limitation of human brain, every field of society cannot be dealt by it. Therefore by employing AI, expansion of human intelligence can be achieved [11].

Study by Winston, suggest that a machine can be called as intelligent if one is convinced by the performance given by the machine is same as that of a human or when the machine can imitate the thinking function of human brain [12]. AI enabled the act of imitation of human intelligence by machine. As a subject, AI relates with the simulation of human intelligence, emotion, intuition, potential, tacit knowledge and personalized intelligence [11]. It consists intelligent technologies that are so developed to follow the similar working as that of a human brain leading to the creation of robot, image recognition, speech recognition and so on [13]. The advancement of different application domains such as Internet of Things (IoT), big data and cloud computing can result into hyper automation and hyper connectivity between the human and machines leading to fourth industrial revolution [14]. The basic need for the enhanced performance

of all the technologies lies with AI [15]. It is an umbrella technology influenced by different technological developments. Therefore, different subsets of AI are explained in the following section of the paper:

### 3.1 Machine Learning (ML)

In 1959, Arthur Samuel defined machine learning as a “Field of study that gives computers the ability to learn without being explicitly programmed” [16]. ML is an automated process that enables the computer to learn from data, after systematically analyzing statistically significant pattern between them [17]. It means ML is inherently related with the element of data analysis and statistics [18]. ML is a significant subset of AI that enables the system to obtain cognitive insight, make predictions and support decision making [19]. ML allows a computer to develop its own rules using algorithms. It does not require any explicit programming for performing its functions rather, it analyze the data available, forms patterns using that data and infers results out of it [20]. However, machine learning requires large data set in order to train the computer to perform a task without requiring any prior command from the user. It actually allows a computer to sense its environmental activities and adapt itself according to the changes taking place [18], [4]. Since machine learning leads to the adhering of logical capabilities by the computer, Parasuraman (1997) regarded ML as the automation of cognitive functions of human [21].

So in conclusion machine learning objective is to make accurate predictions for future events based on available past information and with the help of efficient algorithms [18]. Howard stated that machine learning algorithms as advanced software methods that can help a computer to form its own rules after analyzing the pattern of relationships between the data [20]. ML algorithms can be used to model complex dataset having parametric characteristics and is considered to have accurate predictive capabilities comparatively than other parametric classifiers. Predictive analytics are applied based on the different types of data provided to the machine. In the study “Artificial Intelligence: Implication for the future work” explained different types of learning that are the part of ML [20]. These are the supervised learning where training data sets are provided to the machines properly labeled by a human expert, unsupervised learning when machine is required to make predictions on the basis of unlabeled data set

by forming clusters, learning from the series of pattern, semi- supervised learning where the combination of large amount of unlabelled data and small amount of labeled data are used to gain understanding of dataset and reinforcement learning where machines generate their own data set through experimentation [20].

### 3.2 Robotics

Robotics is the technology employed in developing anthropomorphic mechanical devices known as robots [22]. The American Institute of Robotics, 1979 defines a robot as “a reprogrammable, multifunctional manipulator designed to move material, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks”. Robots may have a physical human like appearance and are playing important role in today’s era. The penetration of robots is in different sectors including education, academic researches and healthcare [23],[24],[25]. Traditionally robotics dealt with development of robots that performed repetitive tasks, and ignoring the element of automation and self- learning [26], but AI- enabled robotics has made its way into the field of high-precision and decision making using algorithms instead of mere programming [27]. AI- enabled robots are referred as intelligent robots consisting of sensory apparatus such as camera and artificial brain [4]. Hence, robotics led to create a balance between efficiency, scalability and flexibility in an organization [28]

Parasuram & Riley explained robots as the automation of physical functions of humans guided by machine learning algorithms [21]. Currently robots are engaged in different acts of providing psychological satisfaction along with carrying out physical activities. Robots equipped with AI- intelligence are autonomous and can learn from the surroundings or by watching the working of humans around them [4]. Study by Yang et.al presented that an emotionally aware robot can be used as an outlet of feelings providing mental relief and improving quality of life. A human-to- robot interaction allows the emotional interference and the user can share emotions without the fear of being judged, as it happens in the case of human- to human interaction [29].

### 3.3 Expert system

An expert system is imitation of decision making ability of human based on some rules, these



rules describes what one needs to do while encountering certain situation [30]. World's first expert system was developed in the year 1965 by Edward Feigenbaum and Joshua Lederberg of Stanford University in California [31]. The computer using expert systems utilizes the experience of more than one expert on a specific problem, and then applies this expertise for drawing out inferences for the user (Waterman & Frederick (1982) as cited in [32]. Zwass explained expert system as the heuristic methods of decision making followed by humans in addition with the ability to learn from experience [31]. In this way it saves knowledge equitable with that of an expert but it is not necessarily a replacement of a human expert [33]. The human expertise is incorporated within the machines by adding some questions and answering them, also adding 'IF-THEN' statements [34] to avoiding any conclusion that does not fits with the data provided.

Expert system have two components: knowledge base and inference engine, where the former consists database of facts required to take decisions and the latter involves analysis of data and all other mechanisms required to attain the conclusion [34],[35]. In order to maintain the authenticity of facts in the knowledge base, information is acquired from a human expert through interviews and observations [31]. Genuine data adds more accuracy in the inferences drawn by the system. Expert system supports accurate decision making while dividing task into analytic and synthetic category. Analytic tasks are explicitly listed and only require valuation of alternatives; whereas synthetic tasks are in bulk quantity and hence involve drawing of alternatives [36]. A study conducted by Edwards [37], analyzed the role of expert system in decision making and found it effective at operational level and tactical level, which also stated limited applicability at strategic level expert system is found effective as well as efficient in organizational decision making.

### 3.4 Artificial Neural Network (ANN)

Artificial neural network is a method of processing inspired by the interconnectivity of neurons with human brain and nervous system [38]. It is the artificial creation based on computational principles used by the nervous system [39]. ANN defines the learning capabilities of human brain which are utilized in different ways namely, simulating human brain by computers [33]; reproducing algorithms on interaction of brain with its environment and understanding the transition

process from simple to complex behavior [40]. ANNs have same structure as that of neurons in a human brain. Each neuron is interconnected with the help of end called nodes or processing elements [41]. ANN learns from the data that are passed through the elements. During the process of data flowing, ANN takes the note of every pattern and learns these patterns known as learning by experience [34]. However, in ANN research learning differs from its usage in neuroscience and psychology. Here it is the process of interpreting the patterns from the input data and then encoding the same into the parameters of the network [42],[43]. Also there are two fundamentals of artificial neural network i.e. supervised ANN which involved learning through the set of labeled data then providing with new dataset (examples) follow similar patterns to analyze and produce correct results. The second is unsupervised ANN which deals with the large amount of unlabeled data consisting different patterns, here the input data following similar pattern are combined to form clusters, and output is obtained by indicating the cluster to which the pattern belongs [40],[43]. In today's technology enabled business practices, ANN is penetrated into every possible field including accounting, auditing, customer analysis, finance, and marketing [42], credit risk assessment [44]; system engineering (fault detection) [45]; prediction [46], estimation, pattern recognition [34] and optimization problems [38] and many more. It has emerged as the biggest contributing subset of artificial intelligence in achieving super intelligence however it still lacks in approaching cognitive capabilities of a human being and far away from approaching the abilities of animals too [43].

### 3.5 Data Mining

Data Mining is defined as the process of identifying valid, potentially novel and ultimately understandable patterns in data [47]. It is known as the process of extraction of viable hidden information from the large databases [48]. The origin of data mining as a discipline belongs to the field of machine learning, statistics and pattern recognition [49],[50]. The two main classes of data mining are model building and pattern discovery. The former is descriptive summary of dataset including regression, Bayesian network; and the latter is discovering relationships between the unlabelled and irrelevant data [49] seeking regularities in dataset including clustering, decision tree and NN techniques [47],[49]. Since no information is explicitly available in the databases, therefore to retrieve useful details data mining

etiquette are applied. By using descriptive and predictive data mining techniques information from the database are extracted. Descriptive technique deals with the properties of input data while predictive technique draws inferences from the input data to find out the missing data [48].

Data mining helped to get meaningful information from the large database commonly referred as big data. Big data refers to “various forms of large information sets that require special computational platforms in order to be analyzed” [51]. Data mining when utilizes for big data brings more efficiency in its functioning. It is therefore characterized as having 5 V’s: Volume, Velocity, Variety, Veracity and Value by [52]. It can establish viable relationship among the data which is difficult otherwise [50]. The process of data mining is inductive in nature allows the researcher to have an in- depth evaluation of data for recognizing patterns between them, to understand previous relationship, to making prediction, and to develop rules and theories [50]. Therefore, the aim of data mining is to utilize the data optimally providing financial as well as non- financial benefits to the user [53]. Researchers [50] identified the areas including trend analysis, association and link analysis, extreme case analysis and variable interaction identification, profiling and segmentation where data mining is successfully implemented. A study highlighted numerous benefits and capabilities data mining offers to an organization [54]. It includes prediction of corporate trends, improving decision making of managers, consistent innovation [55] and increasing the competitive urge of a firm.

### 3.6 Natural Language Processing (NLP)

Natural Language Processing (NLP) is a branch of computer science, linguistics and artificial intelligence. It enables the interaction between human and computer by extracting the meaning out of the input provided in order to perform the task given by the user. The objective of NLP is to translate human language into the commands executable by computers [56]. From the research view point, NLP is concerned with the integration of information related to the understanding and utilization of natural language by human and then to develop tools and techniques enabling computers to adhere the instructions provided by humans in their natural language [57]. The two areas where NLP focuses are natural language understanding (NLU) and natural language generation (NLG) [56]. The main task of

NLU is to extract the meaning out of the words spoken or written [57] while NLG deals with the formation of text in natural language understandable by humans on the basis of data provided such as image, graphics, audio, video [58]. NLP which is often referred as “computational linguistics” is actually different. Computational linguistics deals with the automation and interpretation of human language, keeping ‘language’ as the primary object whereas NLP deals with the development and analysis of computer algorithms for processing of human language by the computers [59]. However, to comprehend language NLP follows the same process as those of traditional linguistic analysis pursue i.e. phonology, morphology, syntax, semantics and pragmatics [58]. Phonology deals with pronunciation while morphology involves establishing a relation between the words and consists of lexical and surface form, where lexical deals with the dictionary meaning of a word and surface form means the way word is being spoken. Syntax consists of application of grammatical rules and structure of a sentence; semantics involves meaning of the word and sentences; and pragmatics consists of knowledge generated from the content in human language [57],[60].

### 3.7 Computer Vision

Computer vision mimics the human visual system with the aim of extracting information from the images available to the computer [61]. Computer vision is among the most powerful tools of AI, as it provides a ‘cite’ to the machine. Like a biological vision, computer vision is an artificial enabled vision provided to the machines. It enables a machine to view things surrounding it by an artificial machine suited eye. It is concerned with the analysis of images from real world and is based on AI and image processing [62]. The terms computer vision and image processing may be thought as essentially synonymous. There is a substantial overlap; there are few important differences in focus. The former deals with the process of image analysis, image interpretation and scene understanding, requiring image as its input for interpreting the scene; the latter consists of image recovery, reconstruction, filtering, compression and visualization [61]. In no time computer vision is able to penetrate in almost all possible fields such as object detection, image recognition, crowd analysis, autonomous vehicle navigation and many more.



A hybrid approach of technology i.e. when computer vision combined with pattern recognition, machine learning computer graphics, virtual reality and augmented reality can achieve better results than working alone (Hartley (2011) cited in [63]. Technological disruptions are making it possible the utilization of a blended form of computer vision. To obtain realistic and practically applicable results computer vision technology should be operated and utilized together. Mahony et al. suggested that the blend of computer vision with deep learning results into more accurate and higher level of performance [64]. Study by Bantupalli suggested to use this combination of technology to enable hearing impaired community [65] to converse with normal hearing by translating the sign language into textual form [66]. By procuring and processing large training data sets it assists machine learning and deep learning in performing tasks smoothly [63].

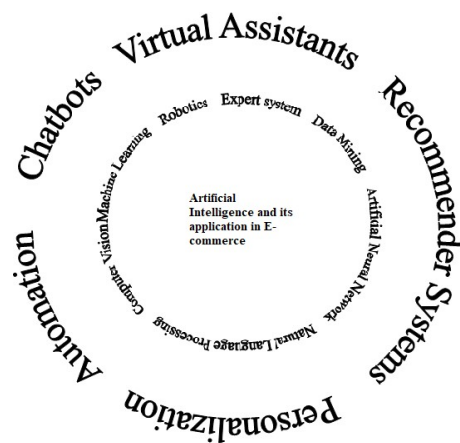


Figure 2: Artificial Intelligence and its E-commerce applications

#### 4. ELECTRONIC COMMERCE (E-COMMERCE)

Before understanding electronic commerce one needs to understand the meaning of the term “commerce”. According to Tassabheji commerce resembles trade; it is an exchange of goods and services on a large scale [67]. Therefore electronic commerce means the exchange of goods and services on a large scale using an electronic medium. According to the editor-in-chief of International Journal of Electronic Commerce, Vladimir Zwass, e-commerce is sharing business information, maintaining business relationships and conducting business transactions by means of telecommunication networks [68]. E-commerce changes the overall working of an organization by

moving into a fully electronic environment involving paperless transactions and automating manual work [69] through Electronic Data Interchange (EDI). EDI enables the sharing of business information between the sender and receiver electronically [67]. The inter-organizational and machine enabled exchange of business related documents in an organized mannered through computerized medium is one the most relevant part of e-commerce ecosystem, that takes place by the way of EDI [69]. The core technological needs of e-commerce are EDI, Internet, Intranet, Extranet, E-mail, Web development technology, database etc [13]

Introduction of network technology bought a paradigm shift in the usage of e-commerce. Initially EDI was an expensive affair due to high cost of private networks, but the advent of internet redefined e-commerce and it became more than buying and selling of goods and services. Internet has extended its trajectory to online marketing, payments, delivery, after sales services, online legal support advice and online business collaborations [67]. Round the clock shopping options and no boundaries of time and geography make e-commerce a viable shopping solution [70]. However, in current scenario when people are having experience in shopping online, need to have a more advanced online shopping mechanism is essential. To retain old consumers at shopping portal and also to increase number of visitors website should be more responsive and dynamic in nature [71].

Personalized offerings and promotion those are possible in traditional way of retailing are not equally effective in online [72]. Therefore, need to have creative content on the website that seem more appealing to the potential customers and bring a sense of enjoyment along with the element of perceived control [71]. Information search emerged as a crucial factor to find the best fit for the consumer. [73], explored information availability as a utilitarian factor to motivate online shopping. Therefore, e-commerce players ensure the most efficient search mechanism for its customers and a proper navigation to browse the website [74]. Along with an efficient search mechanism, a careful analysis of purchase history of consumers may help to fulfill their implicit needs (by Mulvenna, Anand and Buchner as cited in [75]. Personalization in the online shopping experience while analyzing previous data strengthen the loyalty and bonds with the website more than what the aesthetics attributes of the website can do [71].

Research concludes that the assumption about consumer behavior and the advancement in technology are the two main factors enabling personalization [76]. And it can be achieved by embedding two forms of recommendation systems; adaptable systems and adaptive systems. The adaptable systems require users to express their preferences to distinguish their shopping experiences from others. While adaptive systems apply mental or cognitive modeling to offer products matching the choice of consumers [77]. Accuracy in e-commerce personalization is possible while precisely analyzing the implicit purchase intentions of consumers. Also scrutinizing the elements of previous purchases helps to offer appropriate products and services suits the requirement [70]. Shopping mobility by using mobile commerce is another breakthrough in the success of e-commerce [55] where e-commerce activities on mobile phones allowed customers to shop and pay from anywhere at any time while moving from one place to another. E-commerce widens the scope not only for m-commerce rather it also encourages the utilization of other platforms for commercial activities. For instance, marketing through social media portals is widely promoted as it offers dual advantage of social connect along with best deals on products to its visitors. Undoubtedly, e-commerce provides the infrastructure and strengthens the eco system that nourishes e-business [67].

In the current scenario when customer spending substantial time over the internet and accessing shopping related information by using digital device traditional brick and mortar retailers are inclining towards online. Under such complex retail setting where blend of physical and digital channel emerged as a viable form of retailing, knowledge about consumer behavior delivers a strategic advantage [78]. Integration of technology in retail practices may help to obtain more about consumer purchase preference.

## 5. ARTIFICIAL INTELLIGENCE IN E-COMMERCE (see Fig. 3)

Every subset of AI carries its own distinct characteristics and functionalities. E-commerce existed way before the introduction of AI technology. Marketing activities such as product display, its selection by the customers and purchasing were performed even in the absence of AI. These activities were performed manually. The task of assisting buyers during shopping was also performed by human sales agents. But, with the

recent advancements taking place around the globe, consumer psychographics are changing rapidly. Their choices are more technologically driven. That is why it has become a necessity of retailers to adapt the recent technology. Also when large number of products available on different channels making shopping a more complex exercise, technologies helping customer in choosing best product. AI offers the convenience of quick and efficient decision making [79] along with cutting the information overload [80].

Artificial intelligence is drastically affecting the lifestyle of consumers. The way of shopping or consumer's shopping habits are altered to a great extent through the introduction of AI. By making it more autonomous AI is considered to make e-commerce smarter [4]. Availability of high speed internet and surge in the number web users amounted to increase high web traffic which further increases the demands. To meet such multifaceted demand effectively managing big data is essential. However, manual analysis of the massive amount of data emerging from online consumer behavior is a promising challenge and opportunity [81]. AI enabled big data management and its analyzing capabilities may help in better execution of things. With AI capabilities this task is accomplished smoothly. Not only data, but even the management of goods till its transportation is performed through AI capabilities. These different tasks performed by AI contributes to the overall profitability of the firm by benefitting both the ends of the business cycle i.e., consumers and businesses [82].

When it comes to helping the customers, AI is used as an aid in taking their shopping decisions [83]. AI capabilities enable the process of navigating the e-commerce website much easier for them. It helps the customers to not only to complete their purchasing on time but also saves them from information overload [74]. The AI tools used by consumers in shopping are chat bots, voice assistants, face recognition devices and augmented reality [84]. In order to increase consumer's shopping experience, retailers have realized the need to grab and utilize AI [85]. The global retailers like IKEA and Amazon also utilizes AI in their working and this has also provided inspiration to many other retailers in the segment to adopt and implement the same. Logistics and Supply Chain Management are also benefitted by the use of AI. Artificial Intelligence can influence the behavior of the consumers to a great extent with their available data. This requires a careful integration and analysis of the consumer's information undertaken

by “Deep learning” [65]. This information is based on the previous purchases made by them that help in forming the current offer. Deep learning provides a way to train AI to predict outputs, given a set of inputs. The result of good data analysis has led to the creation of chat bots. Due to the invent of AI- based chat bots, consumers are more open to online chat- based AI assistance than telephonic AI assistance. In fact many consumers don’t mind whether the customer service agent is human or machine online as long as they receive the answer to their query.

The level of influence that AI have on a consumer’s choice consists of two aspects; on one hand it can contribute to consumer’s well being by providing easier choice, more practicality while making purchase, and on the other hand it can undermine consumer’s sense of autonomy [86]. Consumers are more dependent on technology based decision making rather than their own choice.

### 5.1 Chat bots

Chatter robot also known as chat bots, is the conversational aid that uses text or voice commands for solving purchase related issues faced by e- commerce consumers [87],[88]. Chat bots are less prone to errors and offers 24x7 problem solving capabilities [89]. AI enabled chat bots are based on Machine Learning (ML) algorithms and Natural Language Processing (NLP). These are able to interpret the meaning out of the conversations made with the consumers as their understanding is not limited to specific commands [88]. The use of Natural Language Processing (NLP) enables Chabot to understand the commands provided by the consumers in human language and generate the responses in the same manner. Machine Learning (ML) enables the chat bots to learn with the experience and provide real time customer service at e- commerce platform. Consumers are able to find products according to their choice, check its availability, compare similar type of products by the help of AI enabled chat bots [13]. Chat bots are designed to conduct complex conversations with the customers, providing 24/7 customer service, and hence leading to greater customer engagement and efficient service support [90]. AI- based Chabot is a cost effective way to accelerate the phase of conversation between the company and its customers. It also empowers the customer and company relationships by solving their queries on time and making them feel prioritized [91].

A study by Adam et al., highlights that even without any human involvement, only the anthropomorphism (human like) characteristics possessed by chat bots influences the decision making of consumers [91]. It ensures the element of personalization as the communication takes place in a one to one manner. the social conversation also satisfies the need of belongingness of consumers [92].

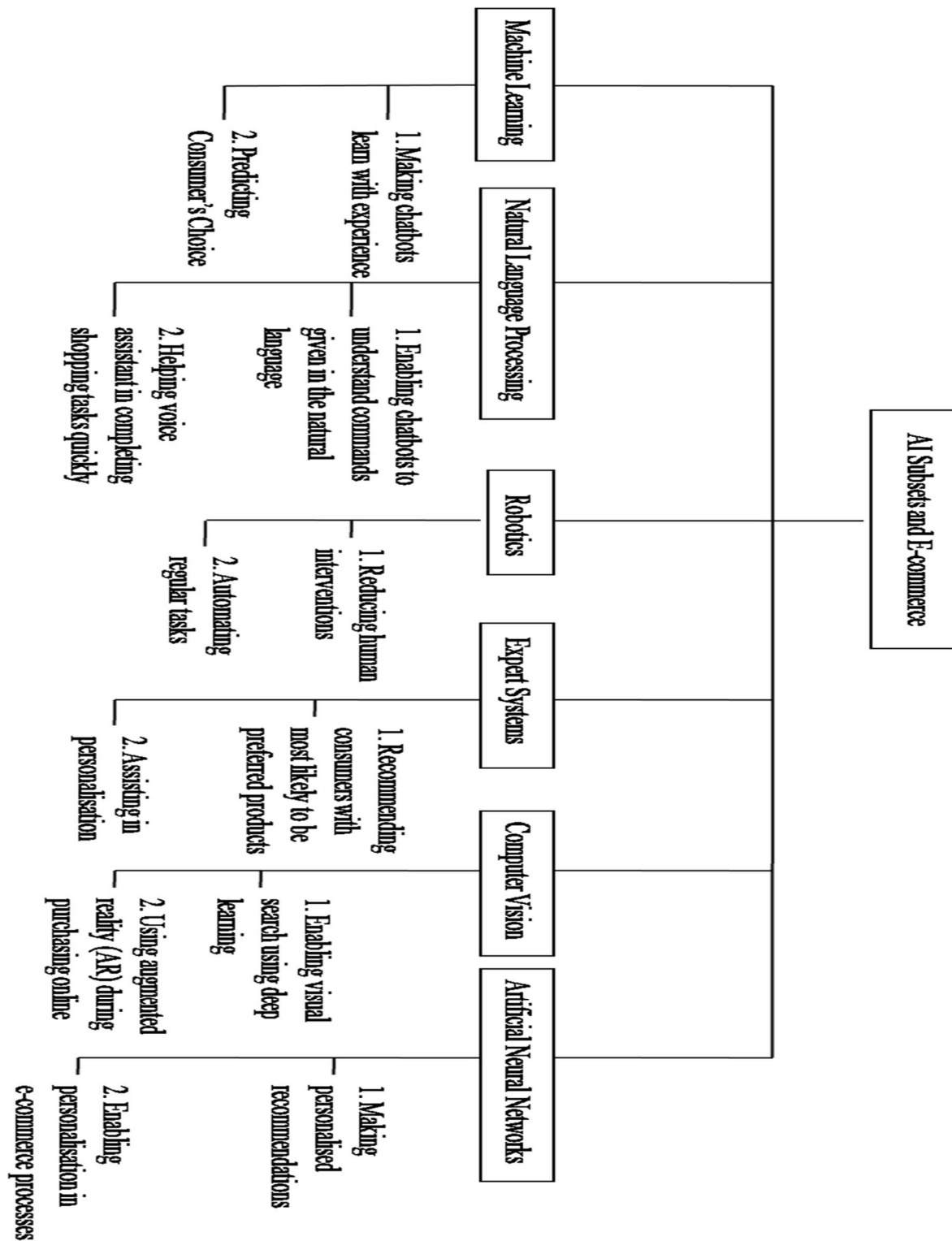


Figure 3: AI Subsets And Their E-Commerce Functionalities

The interaction between the parties using chat bots is not as real as a human interaction i.e. it cannot replace human interaction [88]. But even the absence of a human it is able to carry a successful

conversation that would have taken place with a human attendant. The advantage of using chat bots is that the consumer need not to be very specific with the framing of sentences, as it extract the required information from the utterances and semantics features (features of deep neural network) employed by the consumer [93].

### 5.2 Voice Assistants (VA)

Voice assistants are the software technology enabling human- computer interaction verbally [94]. Voice assistants can be linked with smart phones or voice- user interface. VA interprets the voice commands given by the user and responds via artificial voice [94]. In e-commerce, VAs are used as a customer engagement strategy [95] that also makes the purchase convenient and delightful. A consumer is hand free while shopping over a VA. Voice – User- Interfaces such as Amazon’s Echo or Google Home adds an element of convenience while shopping to the e-commerce consumers. Consecutively, voice assistant have a huge impact on the search patterns of consumers [95]. Along with reducing a shopping time to enriching a shopping experience, VAs can perform multiple tasks that could make the consumers prefer voice shopping over text shopping. The Artificial Neural Networks (ANN) consists of a feature of self learning neural networks that works even on the level of volume of consumers via voice interfaces.

There is no limit to the function a voice assistant can perform. When connected to internet, the VAs access the personal information of the user from the phone, make predictions about the needs of the user and respond to their request with the most personalized option available [96]. Machine Learning enables VAs to analyze the speech patterns and their shopping preferences [95]. With the span of time, the information availability with the software increases (big data) and it is able to serve the customers in a better way [94]. The implementation of AI and ML techniques in analyzing big data, helps in anticipating the customer’s needs and provide them with the best possible guidance to satisfy their needs [2]. In e-commerce, the two implications of VAs can be observed when it also makes shopping easier for those consumers having some sort of disability or literacy issues [94] and for purchasing those products that are purchased on a regular basis [95].

### 5.3 Personalization

Personalization in e-commerce refers to selection of specific digital content for the individual customers on the basis of their characteristics [76]. It enables the user to find the best fit for them that will be more likely to be preferred by them. Inculcating expert system in personalization involves the use of IN/THEN, AND/OR statements for reaching the conclusion of the users [70]. A thorough analysis of customer behavior and technological know- how play an important role in designing a personalized content for the e- commerce customers [76]. Artificial intelligence is the technology that is known for its high degree of personalization as it involves the use of deep learning and data- driven methodologies for analysis rather than rule based systems [80]. Deep learning is used for personalizing recommendation made at the point of purchase [2]. AI- enabled recommendation system ensures personalization by offering the most likely to be purchasable products form a large stock of products to their individual customers [76].

The aim personalization is to minimize the cost incurred by the consumers in accessing information, and enhancing user’s experience [97]. The consumer is saved from ‘information fatigue’ that takes place when faced with some non- routine purchase decisions. AI powered personalized offering makes it easy to take credible decisions [80]. The proficiency in personalization increases the rate of conversion of visitors to prospects and later into loyal customers [97]. In e-commerce, machine learning algorithms are used for the creation of applications that analyzes consumer preferences based on their purchase history, reviews and product usage and offers them the product that can be most preferred by them [80].

### 5.4 Recommendation Systems (RS)

Recommendation Systems are considered as the assisting staff for the online shoppers [98]. It uses the previous purchase history and customer behavior information for the analysis and then suggests the products and services that customer may prefer to buy [99]. In e-commerce, recommendation systems and personalization have a strong connection between each other as the former provides a platform for providing personalized services. From the ML perspective, recommendation systems are the top most applications incorporating personalization [97]. Expert systems help the recommendation systems to assist, and advice the customer while making an online purchase. It also enables the



recommendation systems to take decision on its own based on the prior purchase information [4]. This is an element of collaborative filtering, where the RS presents its customers with the most likely to purchase product without deliberately expressing [100]. The recommendation made is based wholly on the consumer's purchase history. The knowledge base expert system store all the previous purchase data such as preferred size, style, price range and proactively suggest the customer at the time of their current purchase. The application of RS is not limited to the point of purchase of the e-commerce website but is also responsible for adapting the landing page of the websites according to the preferences of the consumers [76].

The recommendation systems based on Artificial Neural Networks (ANN) are also gaining attention for future research in deep- learning [97]. RS are the AI- powered decision support system [101] for the consumers. Machine Learning perspective enables the RS to predict the unseen data as nearly as possible based on train data and methodologies [97] that analysis buying habits of the consumers and then recommend them the product that they are likely to buy. The success of a recommender system lies in its ability to accurately predict a customer choice. In ML, accuracy is achieved in placing correct prediction algorithm, RS can achieve successful results [46]. The AI-powered recommendation systems are very useful and highly effective, as each perspective of AI such as machine learning, expert system, artificial neural networks etc. is well equipped for handling more than one difficulty [101].

### 5.5 Automation

Automation is the process of minimizing human efforts during the purchase process by deliberately presenting them with the most likely purchase option. Automating any task requires a rule based AI application that works with consistency and logic [89]. The combination of big data and micro targeting provide the consumers with more easy, convenient and practical choice of good [86]. Even the subset of AI consist the element of automation within itself. Machine Learning (ML) has automated learning capabilities that need not be to altered every single time [18]. This makes machines more independent it decision making [86].

Utilizing robots in day to day business operations allows human to concentrate on core activities, simplification of work process and enhanced

customer experience [102]. AI- powered robots can take decisions themselves same as that of humans, without any human intervention [14]. Robots in tourism industry are used as front line staff; contribute to the housekeeping services and hospitality related aspects for the customers [102]. Robots can be considered as the key to automation and their tasks can be extended to the automating the transport and delivery process under e-commerce [103].

## 6. DISCUSSION AND CONCLUSION

Artificial Intelligence (AI) has gained an impetus today. Though it is in its early stage of development, the way it transform business operations it is being leveraged across industries and sectors. The ongoing development in the field of AI is making this technology more promising, therefore analyzing its role in improving the efficiency and efficacy of e-commerce was considered important. Currently AI enabled e-commerce transactions are limited to big giants due to its complexities and cost of infrastructure. On the other hands user awareness about AI enabled transactions is also limited, therefore very few empirical study on AI application in e-commerce are available. Even the literature on AI especially its use in retailing is fragmented. Therefore, drawing any fruitful conclusion on the basis of available literature was difficult. This study systematically reviewed the literature and narrow down the available AI related studies to e-commerce. Later, it describes the functionality of each subset of AI in e-commerce. With the best of our knowledge this study is the first to provide the applicability of specific subset of AI in e-commerce working. For instance, robotics is associated with automation of e-commerce task and reducing human intervention. The study have specified the functionality of each subset of AI and it could help the future researchers in finding the best fit of the AI- technology for their research. The digital era with technological disruptions have provided an ecosystem for the advancement and adoption of AI-based technology in our daily lives. Various researches have taken place in the area of AI and its subsets in various disciplines like e-commerce, marketing, and management, for instance virtual fitting room [104], online portable eye wear [105] and many more, but it lacks an element of integration. The study comprised dual aspects of the field. Firstly, the technologies incorporated in the field and secondly, the utility of these technologies in e-commerce. None of the previously presented studies have provided both the

concepts under the same roof. Moreover, the previously presented studies in management have given the functionalities of AI in e-commerce but it fails to highlight the technological aspect behind the same i.e., it failed to show the association of technology with e-commerce functionality.

Chatbots and voice assistant came out as prominently used AI subsets in e-commerce followed by personalization, recommendation system and automation. It is also evident from the review and current pace of AI-enabled transactions that as soon as the technology will mature its acceptance and use will be multiplied. Technologies such as Internet of Things (IoT), big data, artificial intelligence have changed the way e-commerce firm operates. The academicians and practitioners around the world keeps on trying to find the best AI- technology fit that can be suited to the e-commerce. This study aggregated the researches about AI in e-commerce and incorporated various subsets of AI applicable in other field, to widen the scope of AI in e-commerce. It reviewed the different literatures belonging to e-commerce, marketing, IS and management. Though, there is still a need to explore the practical implication of AI in e-commerce, in order to achieve a complete insight of its working. The data was searched from the Google Scholar platform. Literature published in scientific journals as well as conference proceedings became a part of the study for the process of reviewing. In order to achieve a meaningful insight of the elements, different books by eminent academicians were also referred. The search for the literature was based on most frequently used keywords related to AI, most relevant research papers. Review papers and journal articles both were covered for providing the most comprehensive view of the technology.

With the work conducted in this study it can be concluded that AI has more to offer in e-commerce. With the assistive capabilities and element of user- friendliness AI has multiple dimensions to be researched. It will surely attract more researchers which in turn will lead to the creation of possibilities of many practical applications.

## 7. FUTURE RESEARCH AND LIMITATIONS

The paper can become a strong base for future researches in the field of artificial intelligence and its subsets. It integrates knowledge from diverse fields and presents a comprehensive

view of different technologies incorporated in e-commerce. Artificial intelligence is an infant technology for e-commerce, hence there are many areas that are yet to be explored and consists a scope for further research. The AI technological disruptions can be further used as a means to achieve a deeper customer insight with the advancement in machine learning algorithms. The further research can be taken to deal with the one of the drawbacks of e-commerce i.e., lack of touch and feel. A blend of robotics, artificial neural networks and human senses can be develop a model that could allow the customers to virtually feel and touch products available on the e-commerce websites before purchasing them. The advancement of computer vision and robotics consists of enormous scope from research viewpoint, as the future of e-commerce will be entirely based on machines, viewing, selecting and delivering products for consumers [103]. Machines can be considered as the future of the living, the whole e-commerce practice will entirely based on the working of machines, where even the thinking function of the humans while purchasing products online will be performed by them. The shopping assistance [106] provided by the AI-enabled chat bots and recommendation systems today, can further be used as the final decision maker in the future. However, the major limitation of the study is the limited number of literatures analyzed. There could have being some more interesting applications of the technology in the field but the limited literature fails to show its complete picture.

This study has been directed to present a holistic view of AI technology in e-commerce. As stated repeatedly, AI is at a very early stage in e-commerce, studies conducted so far lack empirical testing. Future research may validate the findings of this study and may also review and explore AI application with distinct retail setup, consumer preference and ease of use etc.

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